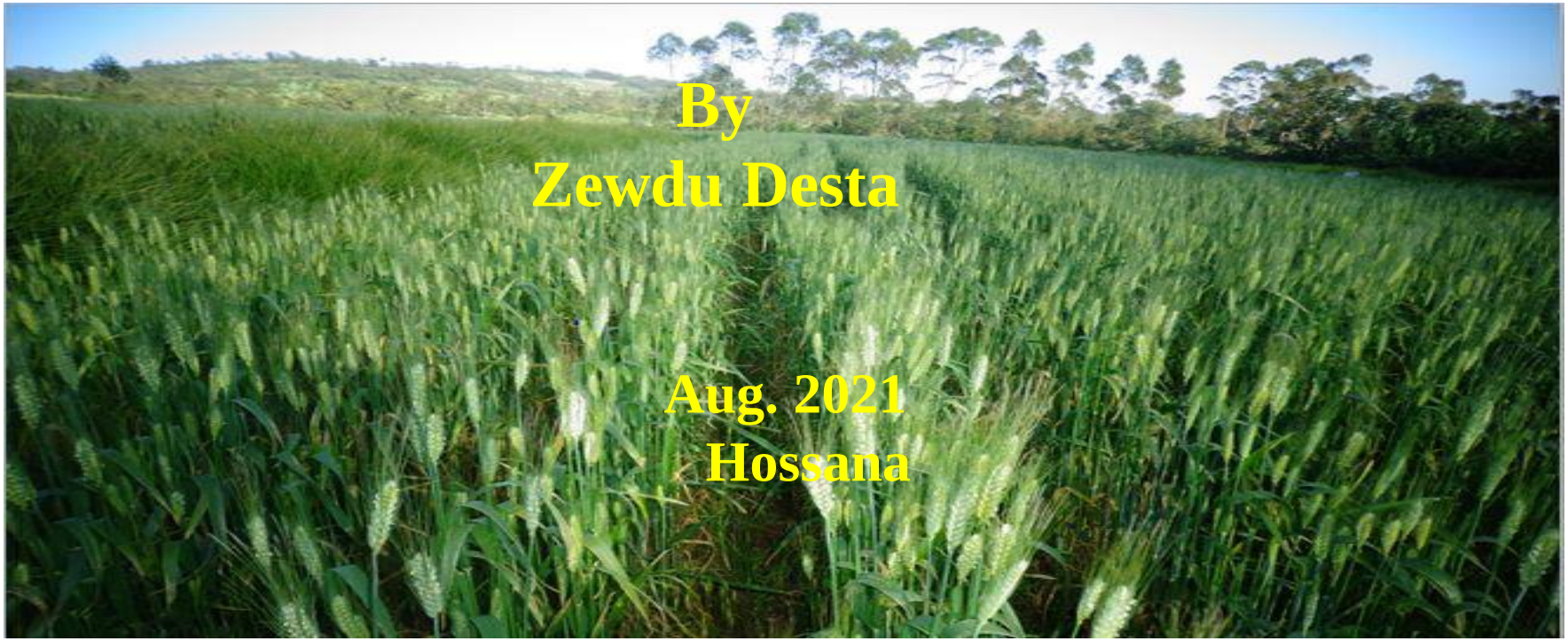
# Training on Soil and Water Conservation Technologies




By

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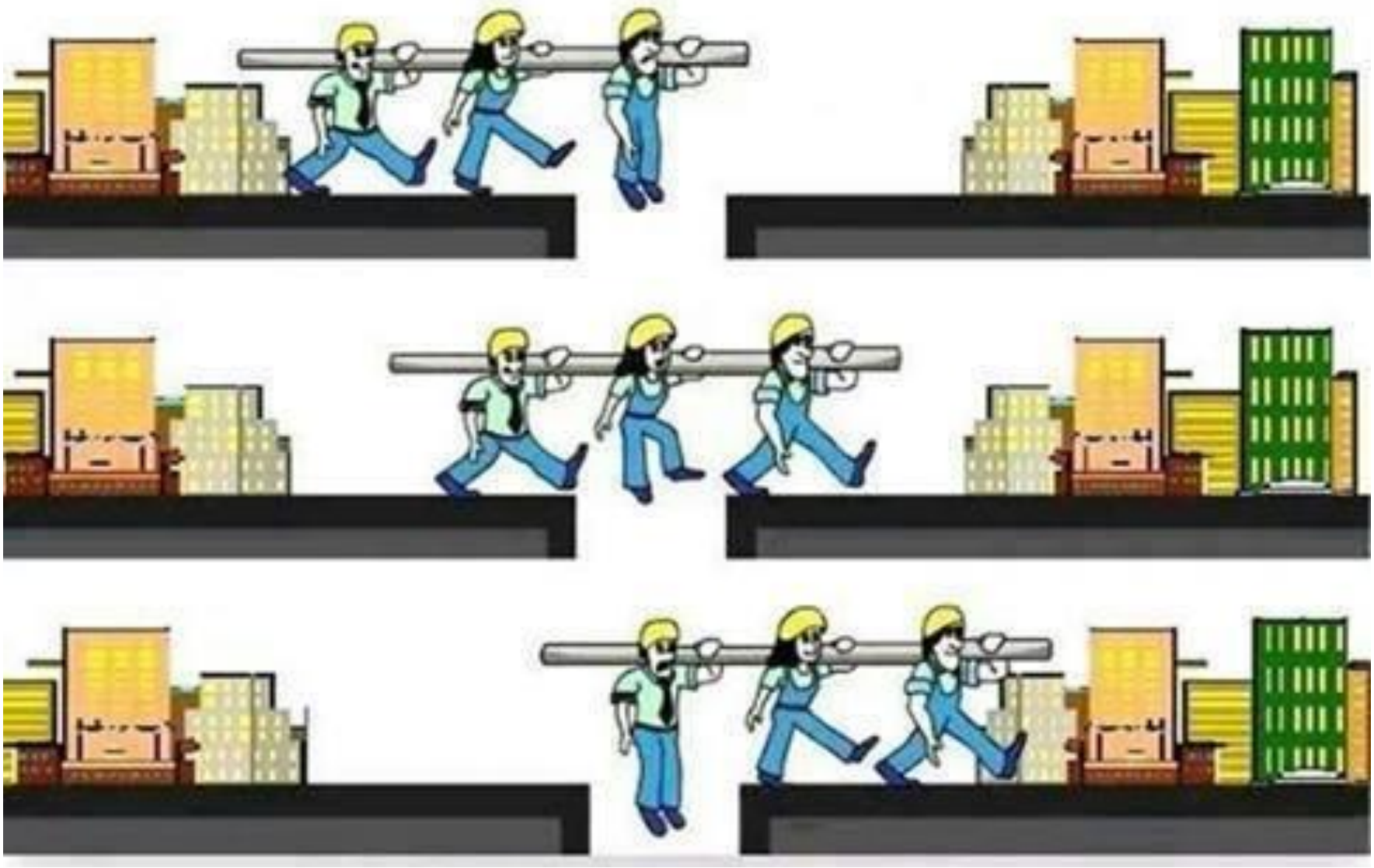
Aug. 2021

Hossana

# Teamwork



# Part l Technology Selection Overview

There are several very determining factors of technology selection:

- Land use & cover
- Slope
- Soil depth
- Soil type (texture) and
- Rainfall are considered in this technologies selection catalogue as selection criteria.

# Cont…

Factors of technology selection criteria are further classified as follows to be used in the process:

1. Land use & cover is classified as:
   - Cultivated lands
   - Grazing lands
   - Bush & forest lands
   - Marginal (degraded) lands
   - Wet lands
   - Homesteads

# Cont....

2. Slope as standard classification :
   - 0-3%
   - 3-8 %
   - 8-15 %
   - 15-30 %
   - 30-50 %
   - >50 %

# Cont…

## 3. Soil depth

- ❑ < 50 cm
- ❑ 50-100 cm
- ❑ >100 cm

# Cont…

## 4. soil type (Texture)

- Clay
- Loam
- Sandy

# Cont….

## 5. Rainfall

- ❑ <750 mm
- ❑ 750-1500 mm
- ❑ >1500 mm

# Part II. Technologies' standard and specifications

**1. Channel bund (soil Bund) (The channel is up slope of the embankment)**

1.1. Maximum length

- Uniform topography---80m
- Rough topography -----60m

1.2. Spacing between bunds

- 3 – 8 %---------- VI=1–1.5m
- 8 –15%----------VI=1-2m
- 15-20%----------VI=1.5-2.5m

1.3. Channel dimension

- Depth-------50cm
- Width-------60cm

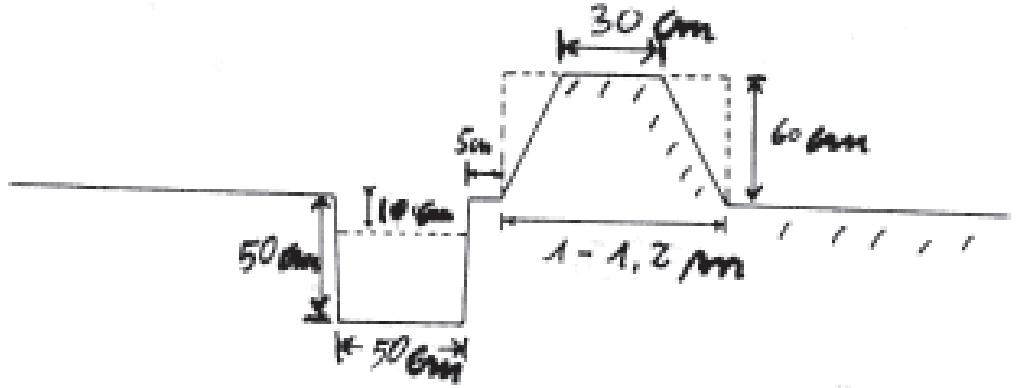
# Soil bund…..

1.4. Embankment dimensions

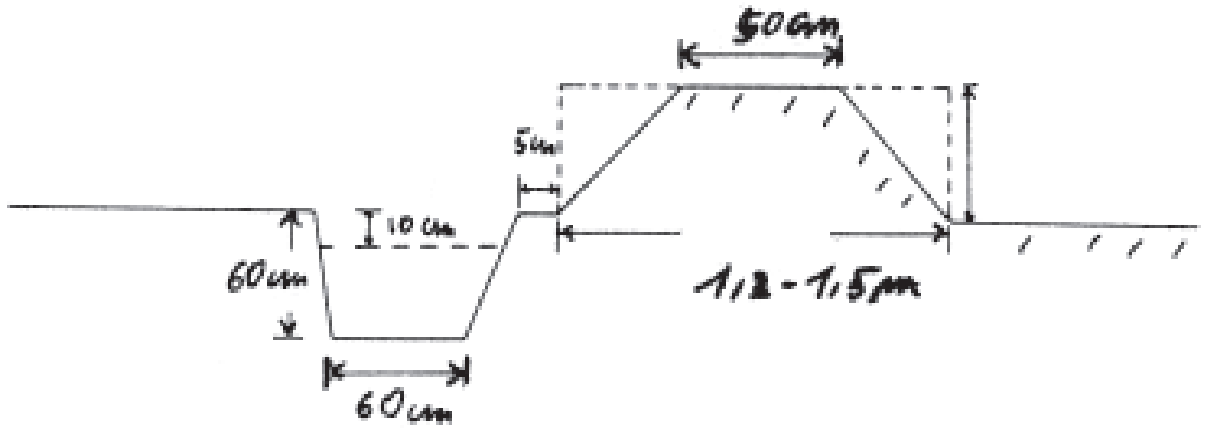
- Height----------60cm (compacted)
- Top width-------30cm for stable soil (50cm for unstable)
- Bottom width------150cm
- Side slope ratio--------1:1
- Burm--------------------20 – 30cm

# Soil bund Layout

a) Profile of bund and collection trench/ditch - stable soil




b) Profile of bund and collection trench/ditch - unstable soil



# Lay out…

- Graded in high rainfall areas (>1000mm) 0.5-1% laterally.
- Non graded in low rain fall areas (<1000mm)

# Soil bund…

1.6. Integration

- With waterways and cut-off drains,(If graded)
- Planting on bunds and fruit trees on the underside of the embankment along the bund.
- Hand dug well with rope and washer pump,

1.7. Maintenance

- Channel bunds are maintained in a form of fanya-juu terrace until bench is formed.

# Soil bund….

# Level Soil Bunds

| Layout and Vertical Interval (VI) specifications | | | |
|---|---|---|---|
| Ground slope % | Height of bund (m) | Vertical Interval (M) | Horizontal Interval (m) |
| 5 | 0.5 | 1 | 20 |
| 10 | 0.5 | 1.5 | 15 |
| 15 | 0.75 | 2.2 | 12 |
| 20 | 0.75 | 2.4 | 10 |
| 25 | 1 | 2.5 | 8 |
| 30 | 1 | 2.6 | 8 |
| 35 | 1 | 2.8 | 6 |

# Soil bund…

Standard Measurement Template /Profile Board for Quality Work Finishing

# Soil bund…

# 2. Fanya juu

A level Fanya juu ("Throw uphill" in Swahili language) is an embankment along the contour, made of soil and/or stones, with a basin at its lower side.

**Needs well drained and deeper soil, slopes of less than 15%, controlled grazing, good for quick benching, needs more labour**

# Fanya juu…

2.1. Maximum length

- Uniform topography---80m
- Rough topography -----60m

2.2. Spacing between bunds

- 3 – 8 %---------- VI=1–1.5m
- 8 –15%----------VI=1-2m
- >15% the embankment is not stable due the water pressure coming above and the gravity pull.

# Fanya juu…

2.3. Channel dimension

- Depth-------50cm
- Width-------60cm

2.4. Embankment dimensions

- Height----------60cm (compacted)
- Top width-------30-50cm
- Bottom width------120-150cm
- Side slope ratio--------1:1
- Burm--------------------20 – 30cm

# Fanya juu…

2.5. Lay out

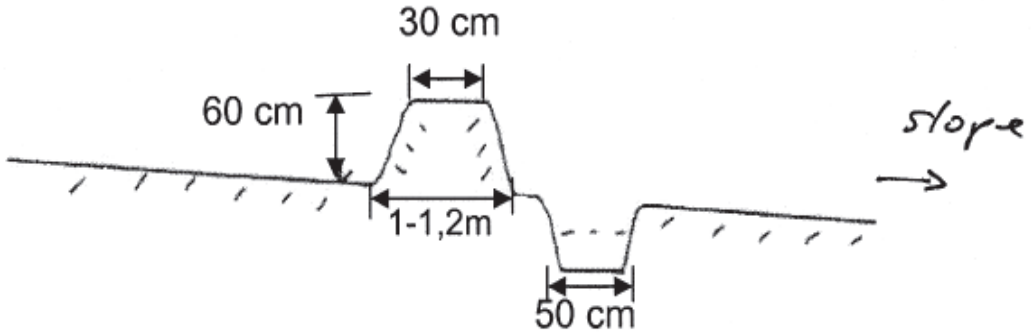
- Graded in high rainfall areas (>1000mm) 0.5-1% laterally.
- Non graded in low rain fall areas (<1000mm)

2.6. Integration

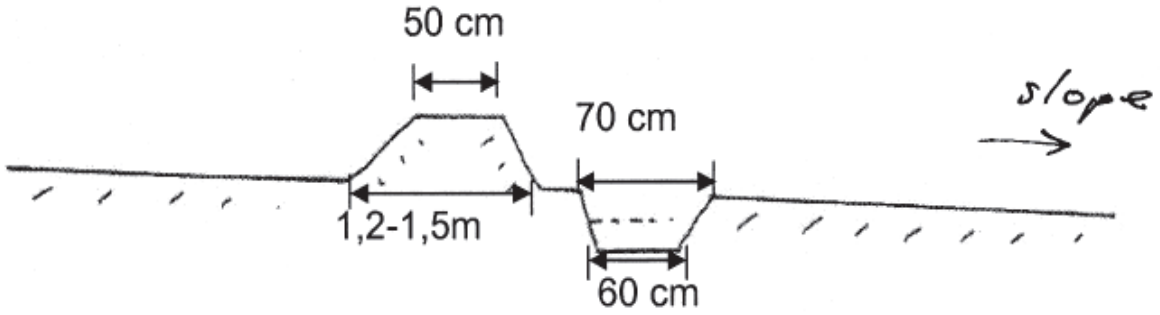
- With water ways and cut-off drains, (If graded)
- Planting vegetation on bunds and fruit trees in the trench,
- Hand dug well with rope and washer pump.

# Fanya juu…

Profile of fanya juu bund and collection trench/ditch - stable soil




Profile of fanya juu bund and collection trench/ditch - unstable soil



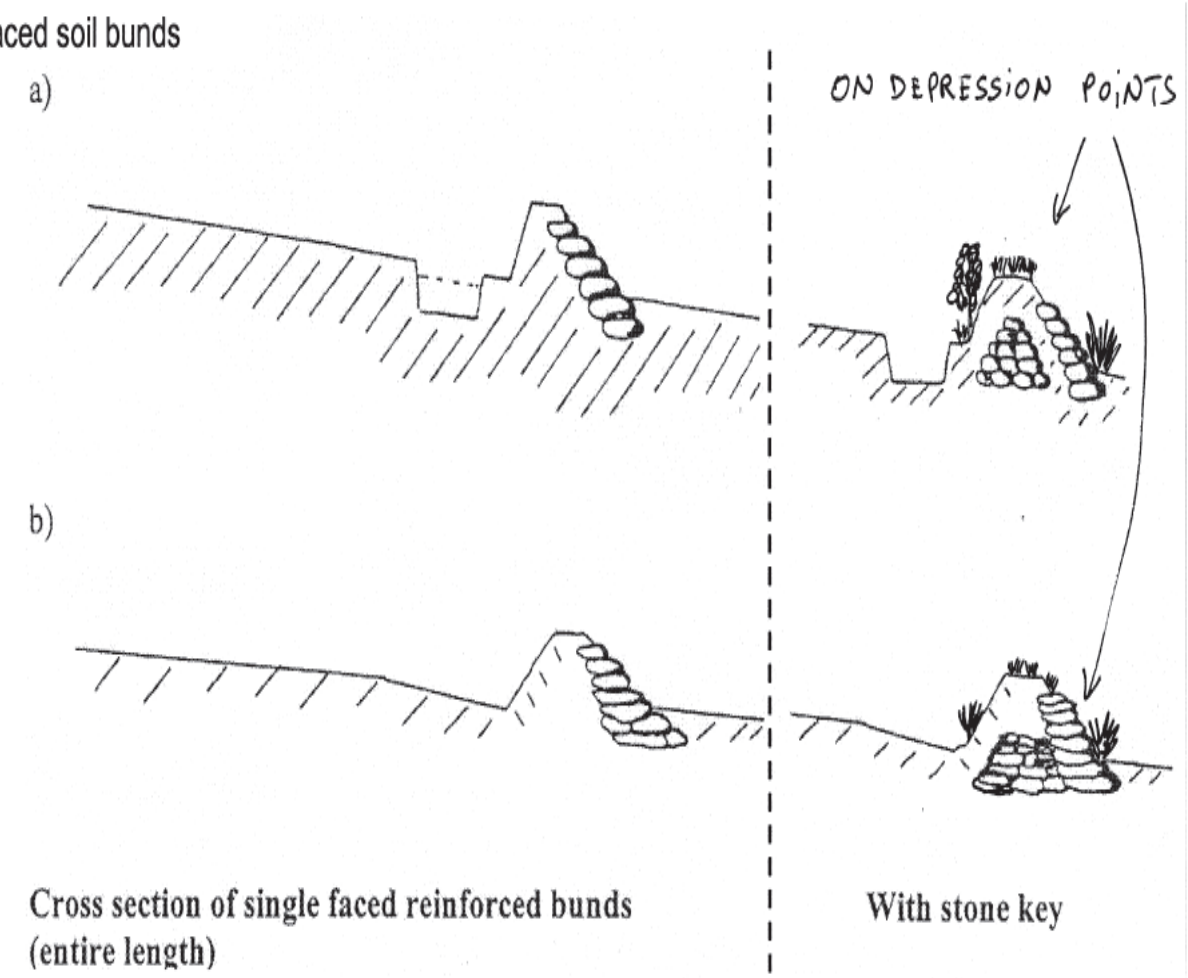
# Fanya juu…

# Fanya juu…

# 3. Stone-faced soil bunds

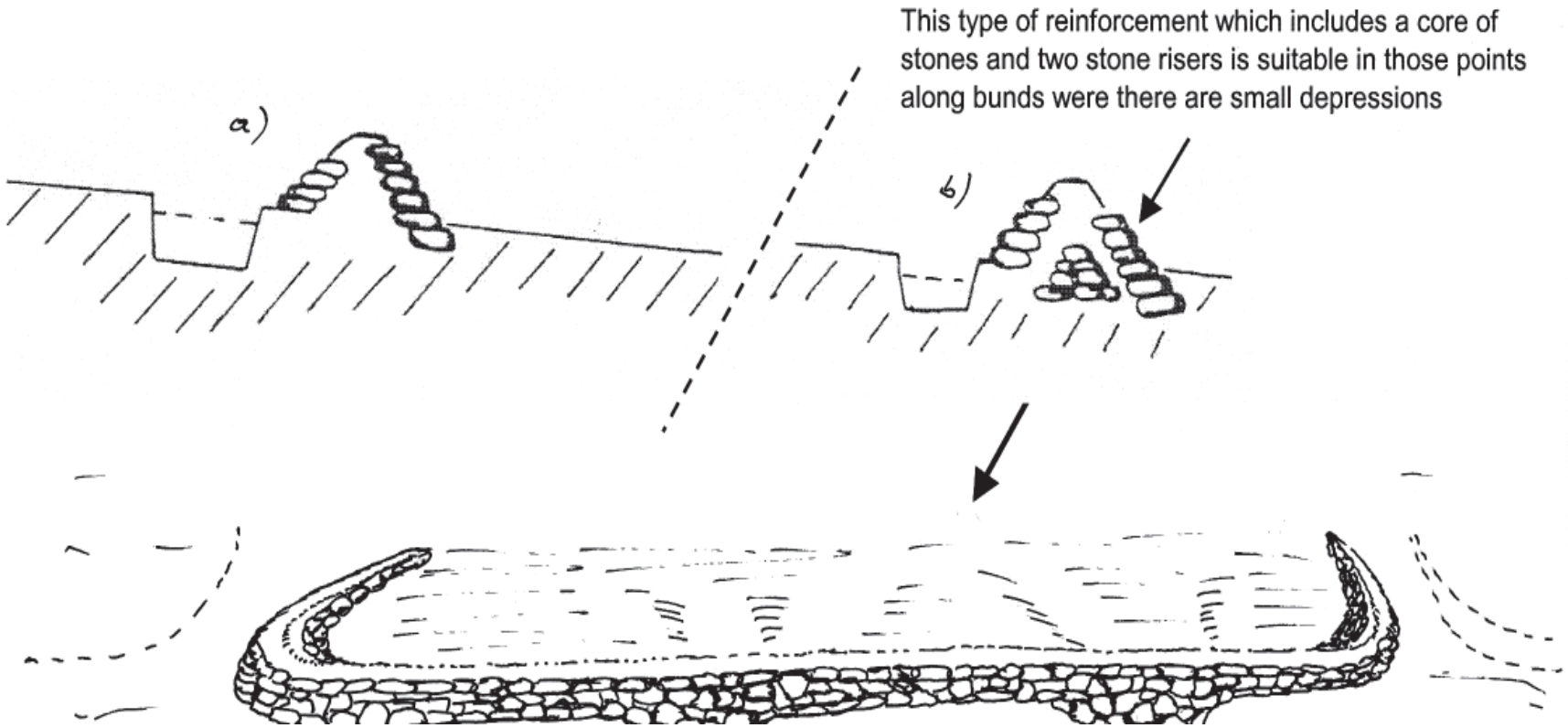
**Spacing and layout similar to that for soil bunds, foundation is stone masonry**

Fig 1. Design of stone faced soil bunds



# Stone-faced soil bunds…

**Fig 2**. Double stone faced bunds with and without stone key (relevant for reinforcements at depression points)



# Stone-faced soil bunds….

# Stone-faced soil bunds…

# 4. Stone bund

4.1. Maximum length

- As required and covenant length, but should allow passage for cattle trafficking

4.2. Spacing between bunds

| Ground slope % | Height of the bund (m) | Vertical interval (VI) in meter | Distances apart (m) |
|---|---|---|---|
| 5 | 0.5 | 1.0 | 20 |
| 10 | 0.5 | 1.5 | 15 |
| 15 | 0.75 | 2.2 | 12 |
| 20 | 0.75 | 2.4 | 10 |
| 25 | 1.0 | 2.5 | 8 |
| 30 | 1.0 | 2.6 | 8 |
| 35 | 1.0 | 2.8 | 6 |
| 40 | 1.0 | 2.8 | 5 |
| 50 | 1.15 | 2.8 | 4 |

- Note: In slopes >35% the structure is not stable. So, it is not recommended to use stone bunds.

# Stone bund…

4.3. Embankment dimensions

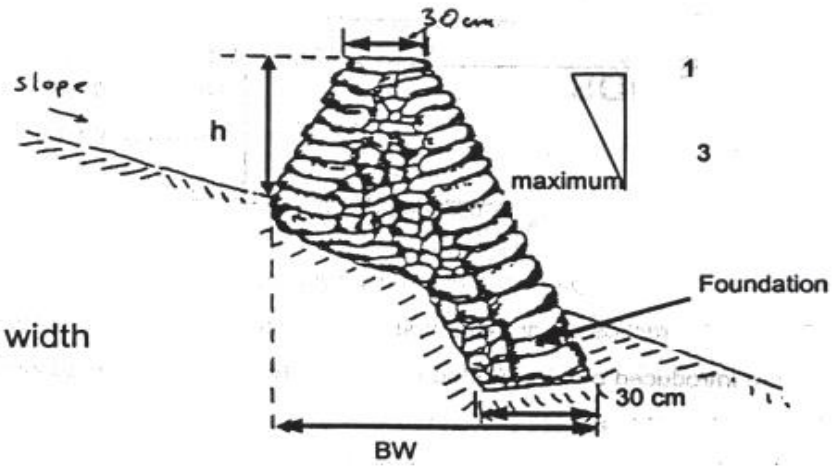
- **Height**: 60 to 100 cm (lower side)
- **Total base width**: (height/2) + (0.3-0.5 m)
- **Top width**: 30-40cm
- **Foundation**: 0.3m width x 0.3m depth
- **Grade of stone face downside: 1 horizontal: 3 vertical**
- **Grade of stone face upper side: 1 horizontal: 4 vertical**
- **Grade of soil bank (seal) on upper side: 1 horizontal : 1.5-2 vertical**
- Bunds need to be spaced staggered for animals to cross Max. bund length 60-80 meters. See Figures below and above.

# Stone bund…

## 4.4. Lay out

- Level (non graded) in all weather conditions (high and low rainfall)

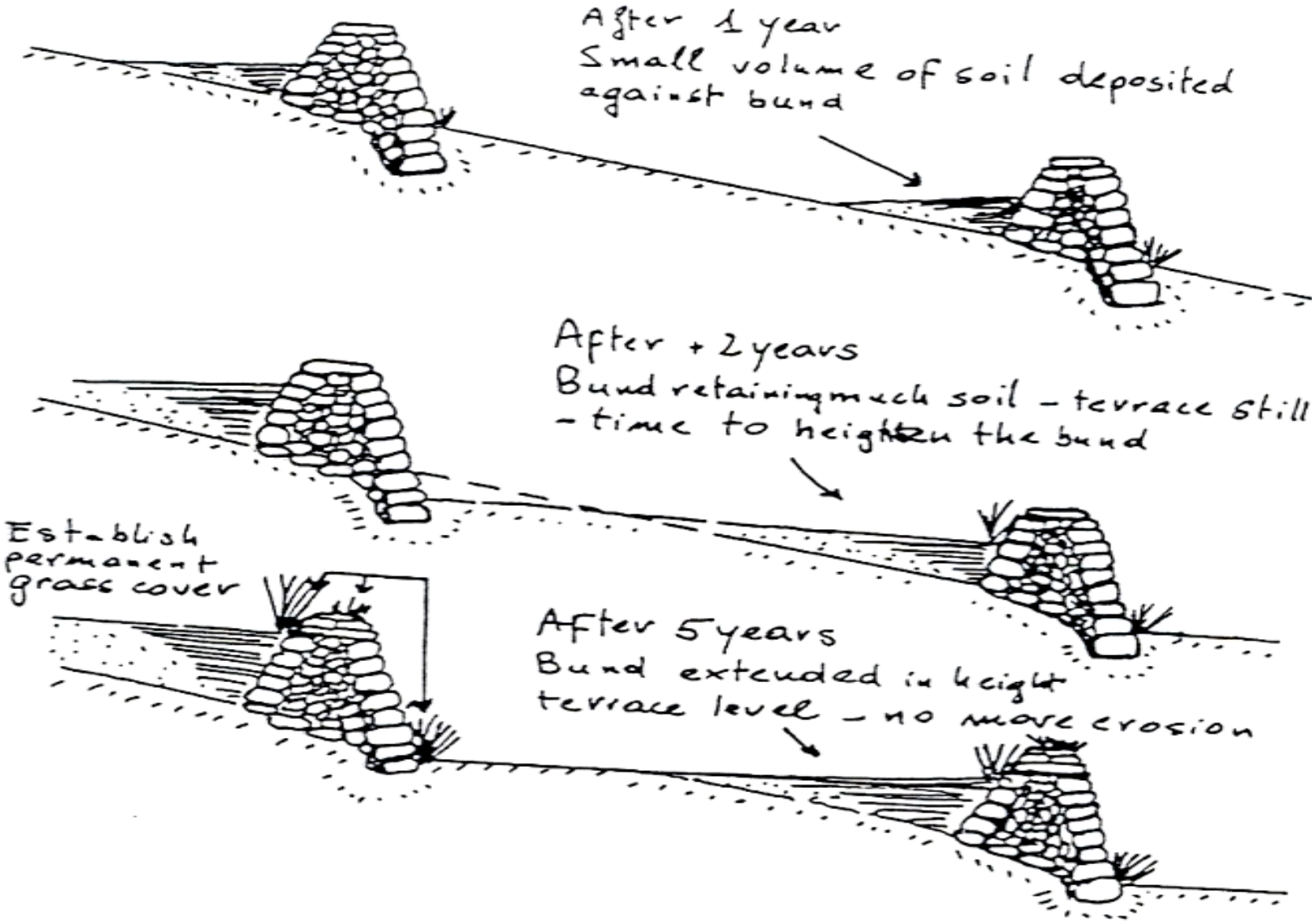
Fig 1. Design of stone bunds




BW = Base width

$$BW = \text{Base width} = \frac{h}{2} + 30\text{-}50\text{cm (minimum)}$$

# Stone Bunds…


After 1 year
Small volume of soil deposited against bund
After + 2 years
Bund retaining much soil - terrace still - time to heighten the bund
Establish permanent grass cover
After 5 years
Bund extended in height
terrace level - no more erosion

# Stone Bunds…

Spacing and layout similar to that for soil bunds,foundation is a must, stone masonry

# Stone Bunds

# Stone Bunds

# Biological Soil and Water Conservation

# Presentation outline

1. Introduction
2. Basics of biological soil and water conservation
3. Biological soil and water conservation measures
   - ✓ Agronomic measures
   - ✓ Soil fertility management
   - ✓ Vegetative measures
   - ✓ Agro- forestry Practices
4. Summary: Tips/Way-forward

# Soil fertility concerns

1. **Topsoil erosion:** the loss of fertile topsoil is ***a combination effect of cultivation of slopes with poor management, high rainfall and inappropriate drainage*** *(water erosion), and significant* ***loss of vegetation cover*** *(deforestation, overstocking, and overgrazing)*

- average annual loss on agricultural land of 137t/ha/year, or an annual soil depth loss of 10-13mm.
- Under agricultural conditions, 10mm lost topsoil takes ~200 years to be replenished
- *On average, 10% of farmlands are converted to gullies*

## Soil fertility concerns ……

2. Organic matter depletion

*no return of animal dung and crop residues to soil, due to competing uses for dung as used for fuel and crop residues used as feed and excessive tillage, among others*

3. Macronutrient depletion:

*farming without replenishing nutrients over time due to leaching, removal of crop residues, cereal cropping , low fertilizer usage …..*

4. Micronutrient depletion:

## Soil fertility concerns ……

**5. Acidity:**

-resulted from;

*high rainfall*

*depleted organic matter,*

*depleted nutrients*

- it is critical problem in the zone

# Major interventions to enhance/maintain soil fertility

- Physical soil & water conservation measures
- **Various Biological S & WC measures**

# 2. Basics of biological soil and water conservation (B-SWC)

- **Definition :**

  - ✓ a conservation measure designed to prevent: **the loss of soil and moisture** through improved **soil management** and **farming practices**.

  - ✓ **it is a rational/balanced land use**, proper land and crop management practice to **increase agricultural productivity** and **ecological stability**.

  - ✓ The underlying factor for the effectiveness of biological soil conservation is the **application of land husbandry techniques**:
    that guarantee:

    - ➢ adequate ground cover in space and time,
    - ➢ the **recycling of organic matter** and nutrients in the agro ecosystem

# Cont'd

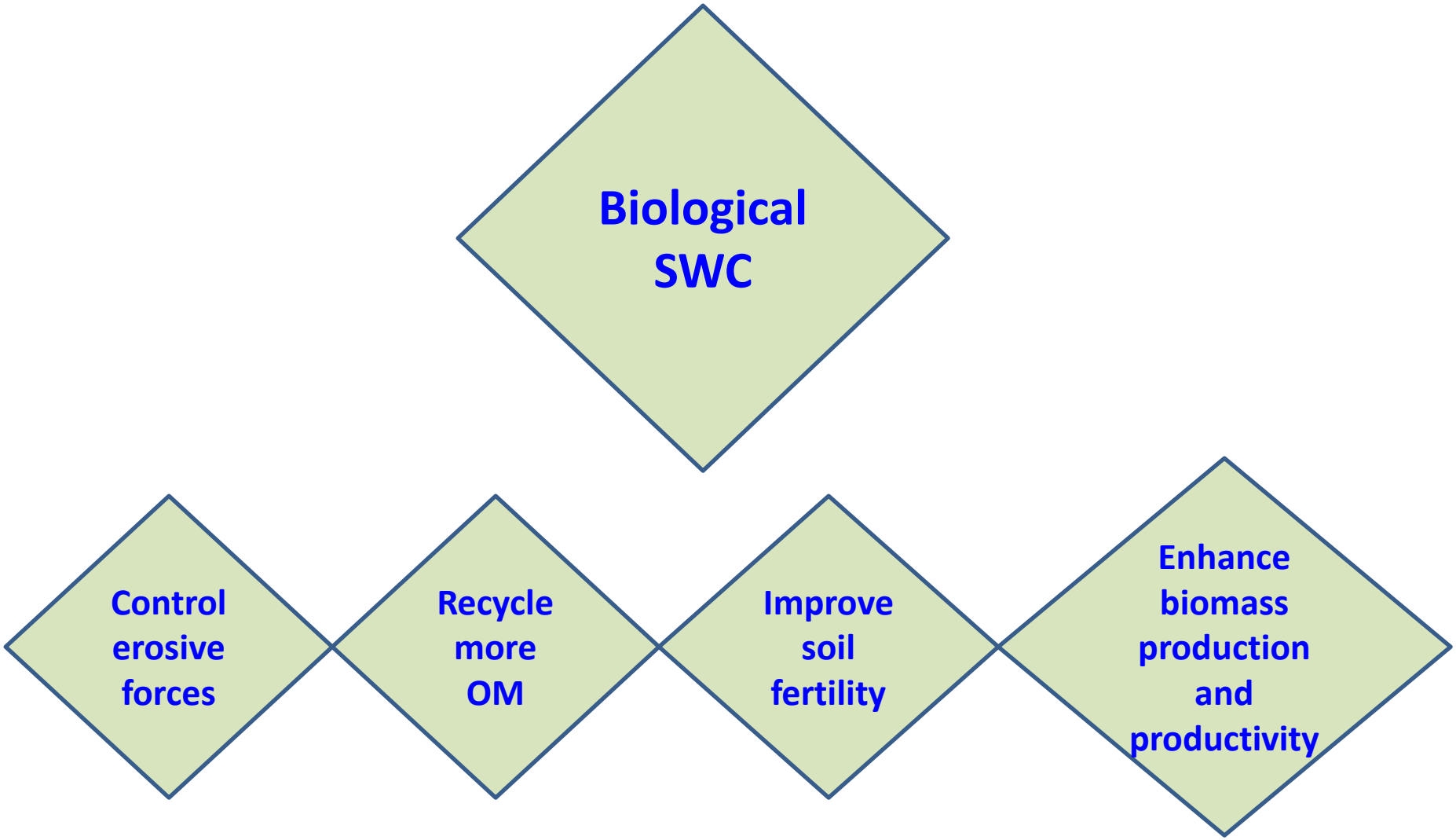
- **Principles:**

There are three basic principles through which biological soil conservation prevents soil erosion:

- ✓ **The first principle** is prevention of the direct impact of raindrops through the provision of **adequate vegetation cover**
  - → the vegetation cover being a barrier to both mass and velocity of the raindrop kills the kinetic energy of the raindrop and its erosivity.
- ✓ **The second principle** is the **prevention of concentration of surface flow** of water that causes runoff.
- ✓ **The third principle** is increasing **resistance of the soil** to erosion:
  - → by improving **soil aggregates** through soil organic matter management

# Cont'd

- **Economic and ecological links in B - SWC:**



# 3. Biological – SWC Measures

- **Advantages of B – SWC:**
  - ✓ Cheap
  - ✓ Provides immediate benefits
  - ✓ Stabilizes physical structures
  - ✓ Can be done by individual farmers
  - ✓ Ultimate solutions

# Cont'd

- **Major Biological – SWC measures:**

  ✓Agronomic measures

  ✓ Soil management practices

  ✓ Vegetative conservation measures, and

  ✓ Agro-forestry

## 2.1 Agronomic measures:

- ✓ There are several agronomic principles and crop management techniques that can reduce soil erosion and maintain or improve fertility of the soil **by providing adequate and all time cover to the soil and improved moisture harvesting.**

- ✓ The measures that can be implemented in various situations are:
  - Crop rotation
  - Intercropping
  - Ley cropping
  - Cover/green manure crops
  - Mulching/crop residue management
  - Contour cultivation

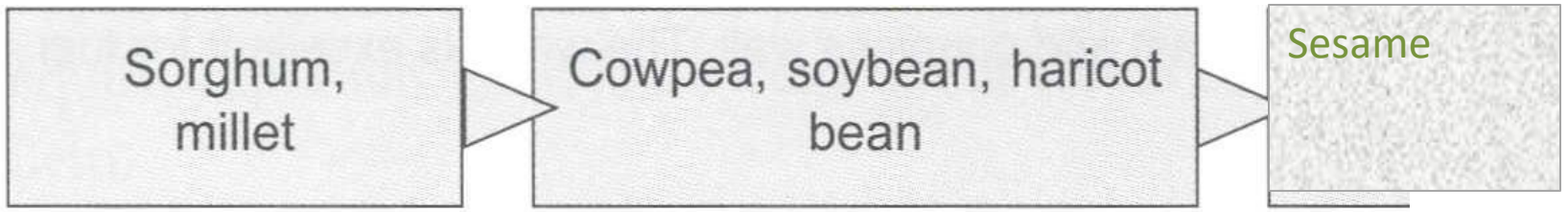
# Cont'd

## A. Crop rotation:

- ✓ **Crop rotation** is a practice of growing different crops one after the other on the same piece of land
- One of the oldest agronomic practices used all over the world
- ✓ **Different crops** have **different morphological** characters (roots and shoots) that enable them exploit the physical resources from different strata.
- ✓ If the same crop is grown on the same piece of land year after year, the soil nutrients in a given stratum deplete sharply and the crop yield declines
- ✓ Usually there are few crops, which are the primary targets for improving crop yields through rotation

# Cont'd

- Some crops restore or build fertility of the soil, while others deplete its fertility.
- For instance, **legumes fix atmospheric nitrogen** and hence enrich soil fertility.
- In contrast, **cereals such as sorghum and maize deplete soil** fertility through their big stalks and biomass,
- As a result, rotating cereals with legumes will have positive effect on soil fertility
- In addition to fertility restoration and SWC, crop rotation can help to control:
  - Disease, pests and weed infestation



# Cont'd

## B. Intercropping:

- ✓ Intercropping is a practice of growing two or more crops simultaneously on the same piece of land at the same time
- ✓ Intercropping systems include: **strip intercropping** and **mixed intercropping**
  - ✈ While the principles and objectives of strip intercropping and mixed cropping are the same, the patterns are different

- ✓ Strip intercropping is a cropping practice where strips of two or more crops are alternately established on the contour for erosion control

# Cont'd

- The practice is useful against soil erosion in **areas where cropping system is dominated by row or sparsely populated crops** that often expose the ground to erosive forces
- As far as erosion is concerned, the **two strip crops should have contrasting characters** in terms of controlling soil erosion.
- If the **first strip crop is a row crop** or a crop, which is **susceptible to erosion**, the second strip crop should be a crop that **effectively controls soil erosion**.
- So, if the first strip is maize or sorghum, the second should be forage/food legume that forms dense ground cover.
- In this case, **maize or sorghum** is regarded, as **soil depleting**/ degrading crop while **the legume** is **soil-conserving crop**

# Cont'd

## C. Ley cropping:

- ✓ A cropping practice in which legume based pastures are rotated with food crops
- ✓ Legume based pastures are grown on fallow lands for some time to improve fertility of the soil and hence replaced by subsequent crops
- ✓ Ley farming has an extra advantage of **linking livestock with crop production**
- ✓ In this regard forage legumes like pigeon pea, siratro and stylos can be used as legume for improved fallow system.

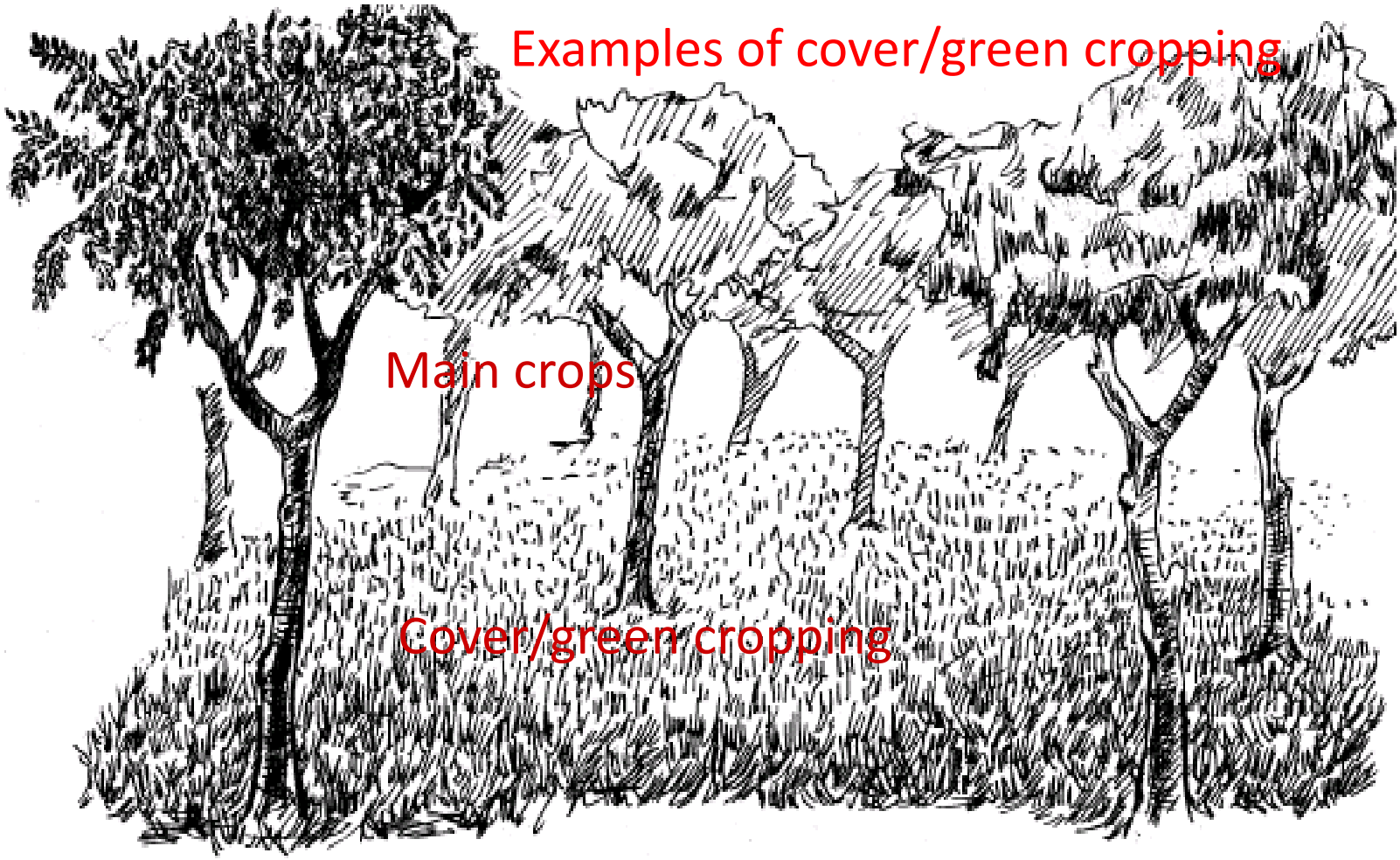
# *Lupinus lupin* used as ley cropping, Ethiopia

# Cont'd

## D. Cover/green manure crops:

- ✓ *Cover crops* are crops grown as ground protection under row plantation crops or as conservation measure on fallow lands during off-season.
- ✓ Cover crops provide proper ground cover to protect the soil from erosive agents.
- ✓ They also play additional role of replenishing soil organic matter and nutrients.
- ✓ Cover crops are grown under tree crops mainly to protect the soil from the impact of water drops falling from the tree canopy

# Cont'd




- Fast growing legume plant
- When the legume flowers, it is ploughed into the soil

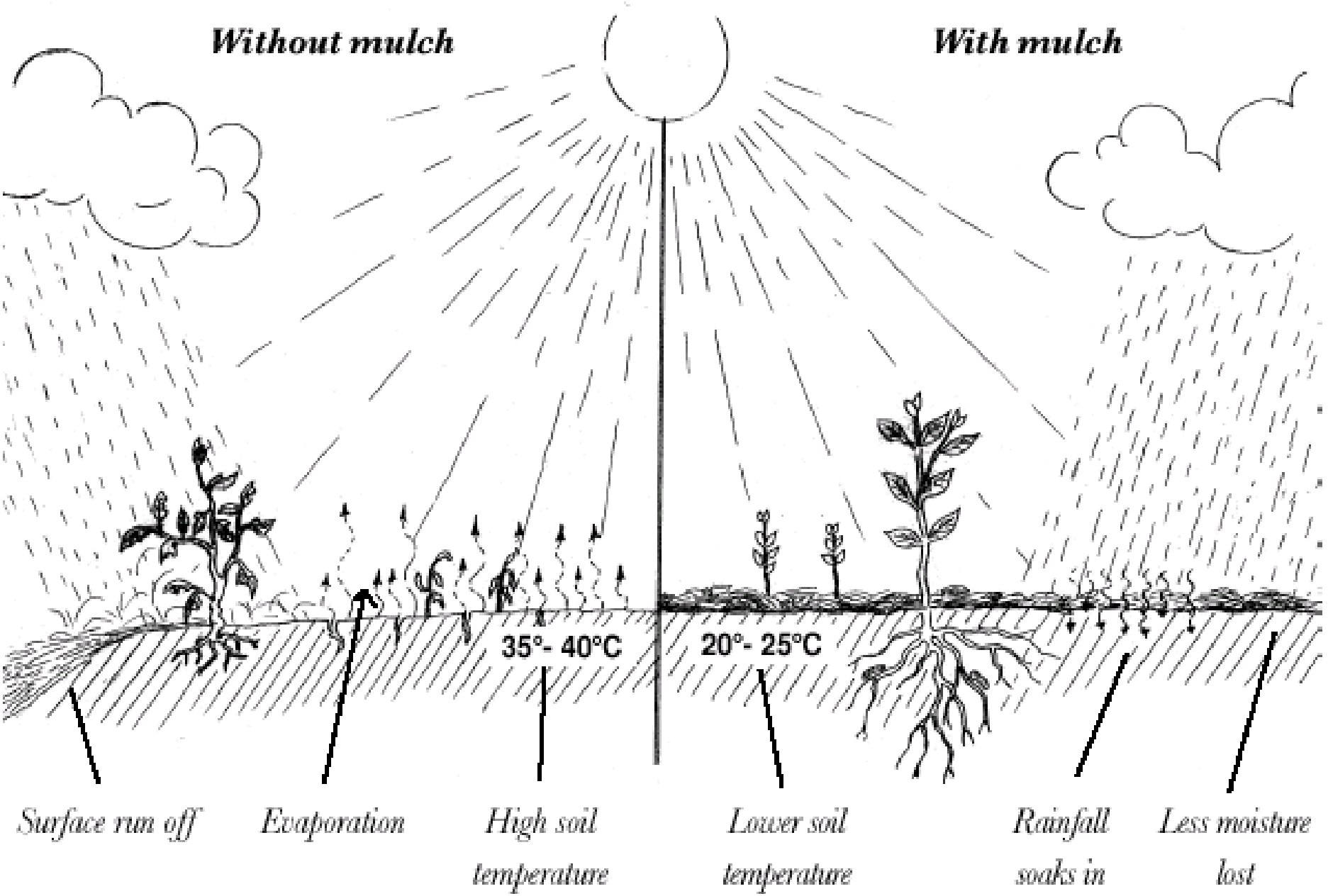
# Cont'd

## E. Mulching/crop residue management

- ✓ Mulching is the covering of the soil with crop residues such as straw, maize or sorghum stalks or standing stubble.
- ✓ Its main purpose is to shield the soil surface from the hot sun and falling rain, minimizing soil crusting, erosion and runoff.

### Advantages of mulching

- creates a favorable environment for soil microorganisms,
- encourages rainwater to soak into the soil,
- reduces the rate of evaporation from the soil surface, so raises the moisture content of the soil,
- It also reduces the temperature fluctuations in the soil.

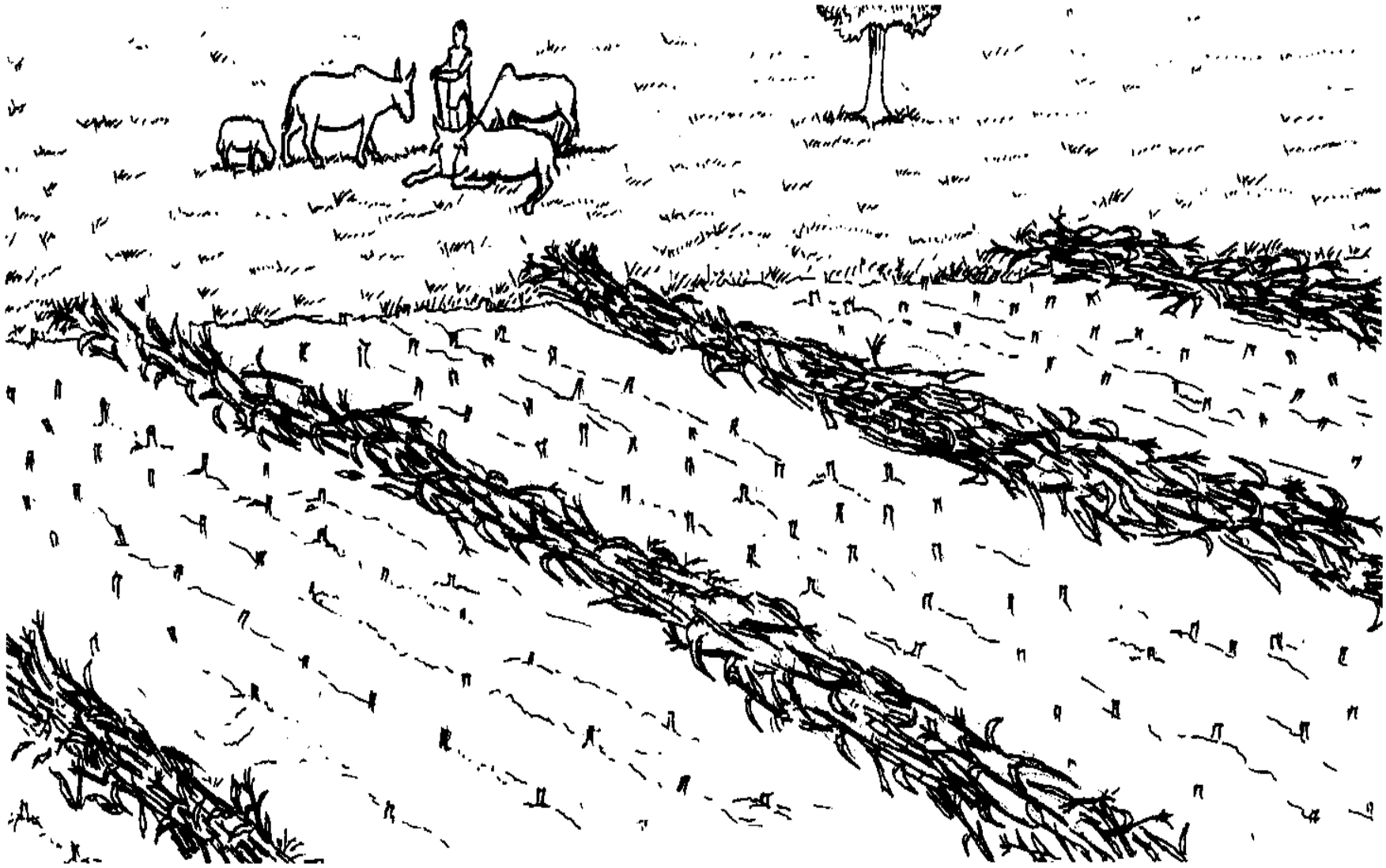



**Effect of solar radiation on crops with and without mulch**

Mulching with Sorghum straw

Trash line with crop residues, (to reduce problems related to tillage operations)

Mulching of crops with residues to reduce evaporation



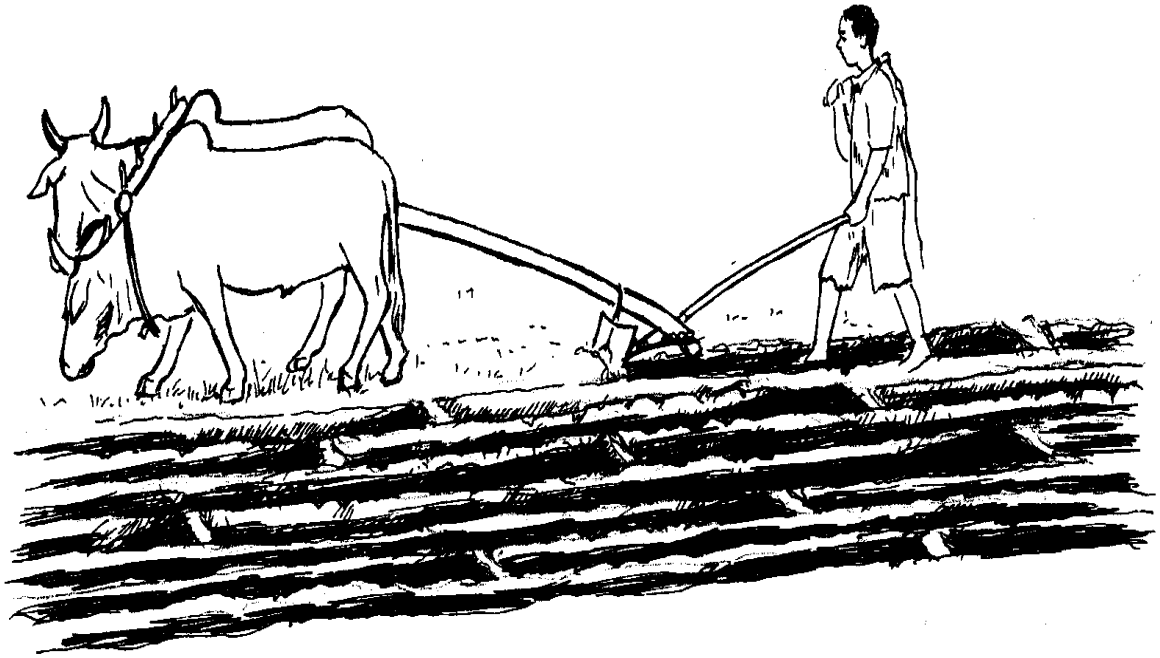
*Trash line on a gentle slope*

# China’s experience in mulching

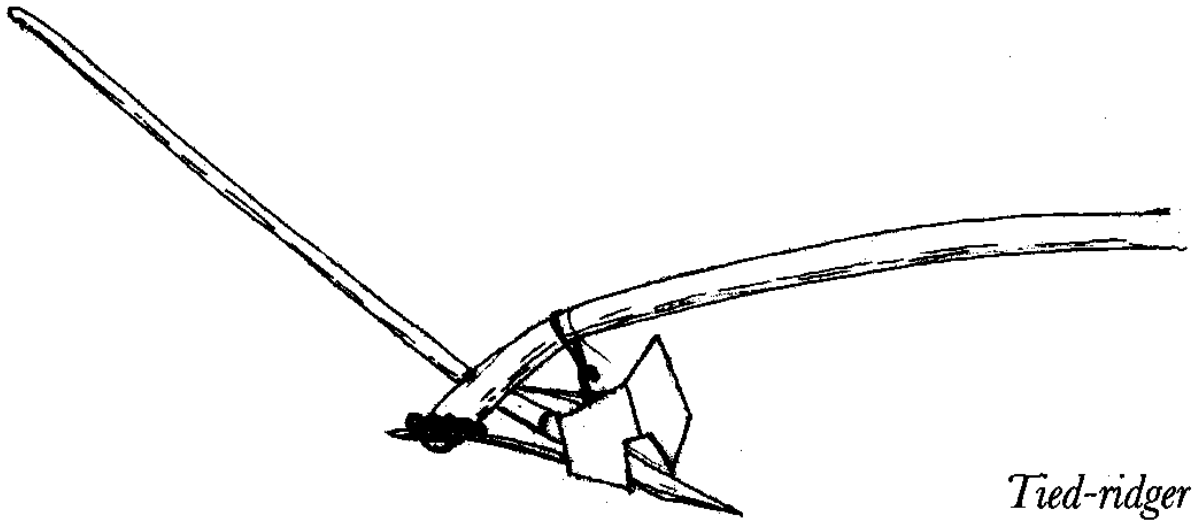
# Cont'd

## F. Contour cultivation

- ✓ Contour cultivation and planting is a practice of ploughing the land and planting crops along contour lines.
- ✓ It can be adjusted to standard ridge and furrow system to make it effective in controlling soil erosion and moisture conservation
- ✓ Tie ridging is the most effective tillage method used for conserving soil and moisture and for increasing crop yields in semi arid areas.
- ✓ Tie ridging is undesirable during years of above average rainfall, because they cause water logging



*Making tied ridges*



*Tied-ridger*

## 2. 2 Soil Fertility Management

- ✓ Soil fertility management refers to the practices applied ***to restore or maintain the physical and chemical properties of the soil to optimize conditions for germination, establishment and crop growth***.

- ✓ There are different measures to be used to maintain the fertility of soil and enhance its productive potential.
- ✓ Some of the measures that are described here below can be used in drier areas :

# Cont'd

- **Fertilization and manuring**

✓ The application of chemical fertilizers to the soil is referred to as fertilization while manuring is the application of various manures (e.g. green manure, compost, farmyard manure, etc).

✓ When farmers cannot afford purchasing chemical fertilizers, manuring could be an option for maintaining fertility of the land

✓ Manure Consists of animal dung and urine.

- It is the best form of organic manure.
- It improves or sustains soil fertility,
- Improves the soil texture and structure, and increases its water-holding capacity.
- Animal manure contains small amounts of nitrogen, phosphorus and potassium nutrients.
- Urine contains more nitrogen than solid dung does, and should be collected along with the dung and used as fertilizer.
- Chicken droppings make the best-quality manure because they are **rich in nitrogen**.
- The manure is kept covered and out of the rain to avoid loss of nutrients.

Manure prepared by a family

# Cont'd

- **Conservation tillage (CT):**

✓ is a tillage practice aimed at creating favorable soil environment for germination, establishment and plant growth **with minimum mechanical soil disturbance**

✓ Tillage operations can loosen, granulate or crush or compact soil structure, changing soil properties such as bulk density and pore size and its distribution

✓ CT is therefore, designed to avoid the distraction of soil structure

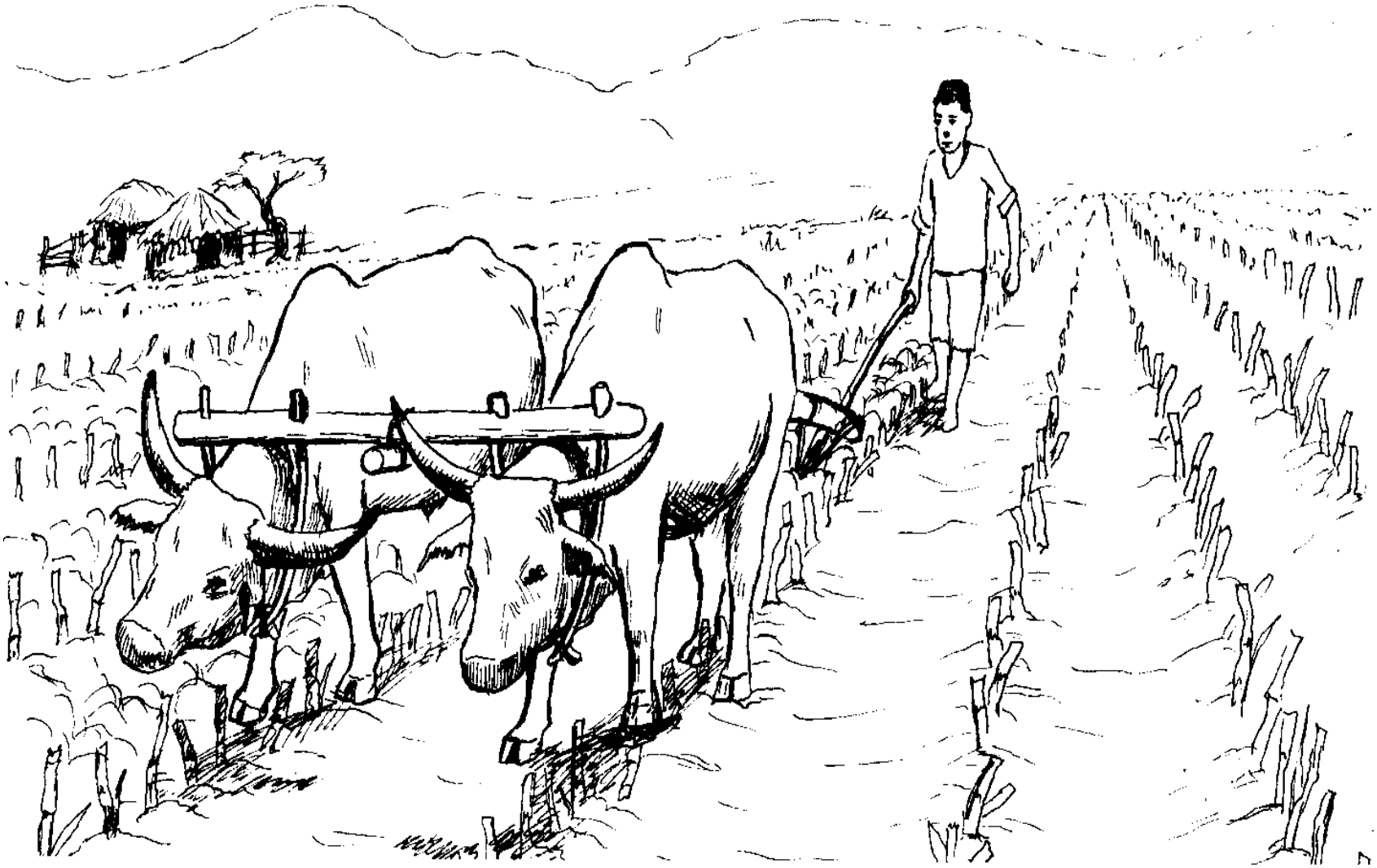
✓ To increase the organic matter (OM) content in the soil, the adoption of tillage systems with reduced tillage depth and/or frequency (reduced tillage) or of no-tillage (direct drilling, direct seeding, zero-tillage) is important.

# Cont'd

- *Zero tillage (no till)* is a tillage practice in which land remains untilled before planting, but planting furrow or hole is opened at planting time

- Minimum/reduced tillage is a tillage practice in which the least possible tillage operation is performed to break up hard pans/compacted layers and hence to increase infiltration/water storage capacity of the soil and to minimize resistance to root development.

  - ✓ In both cases the application of inputs like Nitrogen fertilizer and herbicides may be a necessity.



*With strip tillage, plough only the rows where the crop is to be planted*

# Cont’d

Minimum tillage for low soil disturbance

# Minimum tillage

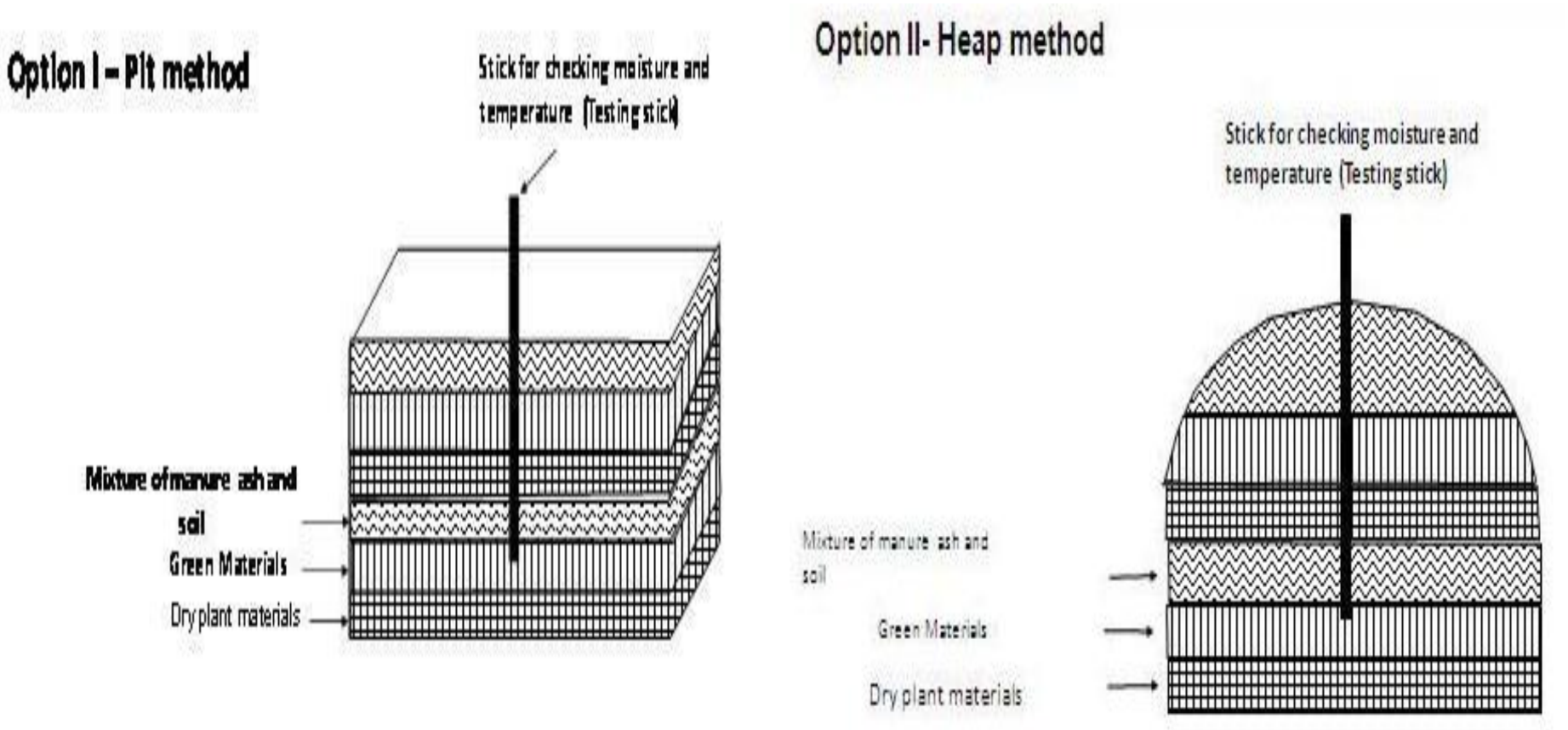
# Compost application:

Compost is the final product of **organic waste materials** that have passed through decomposition processes by microbes

- ✓ Compost is natural fertilizer that contains readily available plant nutrients,
- ✓ Made from leaves, weeds, manure, household waste and other organic materials,
- ✓ Compost is an excellent soil builder. It supplies a wide variety of plant nutrients.
- ✓ It also creates a favorable environment for soil microorganisms.
- ✓ It improves **the ability** of the soil to hold water and withstand compaction.
- ✓ The improvements **increase crop yields** and can last for several cropping seasons

**There are two basic methods of making compost: the heap method, and the pit method.**

# Cont'd




Methods of Compost preparation

# Cont'd

- ***Heap method:***
  - ✓ is a composting method, which is undertaken in an open area.
  - ✓ In this method of compost making, moisture, temperature and aeration are easily controlled
  - ✓ As water freely drains out there is no problem of excess water.
  - ✓ Moreover, it is easy to turn and mix the material for better aeration and accelerated rate of breakdown.

*But this method can not be implemented in dry areas as it is exposed for sun and wind actions*

# Cont'd

- ***Pit method:***

✓ is a method, which requires digging of a pit.

✓ In this method, it is more difficult to turn and mix the material for aeration.

✓ It is also difficult to control moisture, temperature and aeration.

✓ Water logging problem can easily occur, especially during the rainy season entailing the problem of reduced rate of breakdown of the organic materials.

✓ The pit method appears appropriate in the drier areas where water limitation constrained the practice of compost making.

# Cont'd

- ***Site selection for compost making***

  - ✓ The compost site should be away from any source of drinking water, a distance of at least 25 m is needed.
  - ✓ But is should not be too far to economize on labor requirement.
  - ✓ A light and simple roof should be constructed (for heap) to reduce moisture losses as a result of the sun and wind in hot season and to restrict loss through leaching.
  - ✓ It is also advisable to locate compost heap or pit far away from a house and place of regular work to avoid flies and the smell of decomposing material.

# Cont'd

- ***Organic materials for compost making:***

✓ Any organic waste of plant or animal origin will decompose in a compost heap,

✓ But the time required for decomposition will vary with the type and composition of material, and the management situation

✓ The common materials, which can easily be secured, are:

- Animal manure (from cattle, equines, sheep, goats, poultry, etc) provides the **micro organisms with nutrients**. Also it would enrich with (NPK);
- Ashes (from burning weeds or fuel wood) will enrich the compost with P and K and increase **the population of micro-organisms**;
- Soil (at composting site) helps to introduce **soil micro-organisms**.
- Addition of N fertilizers only if they are available is desirable to speed up the breakdown of cereal straws.
- While P fertilizer is desirable to increase the population of microorganisms, the need of P can be met by using ashes.

# Cont'd

- ***Procedures for compost making*:**

✓ both methods of composting follow the same procedure which encompasses the following:

→ Select a suitable site

→ Collect all available organic materials that biodegrade readily

→ Decide how big to make the pit (or heap) depending upon the available material (2 m wide, 1.5 height/depth and up to 4 m length)

→ Spread small branches and other coarse materials such as maize or sorghum stover at the bottom of the pit or heap, to a depth of 10-15 cm

→ Make a layer of organic material about 5-15 cm thick,

→ Then put ash (half a kilo per square meter) over the organic layer

→ Then farmyard manure is spread; a good amount of manure would be three kilos per square meter layer,

→ Spread a thin (1-3 cm) layer of soil on top,

→ Add more layers of organic material, and of soil or ash, until you have used up all the materials you have, or until the pit is full,

→ Push a long, pointed stick (or bamboo pole or reed) at an angle all the way into the heap or pit,

# Cont'd

- → Using a reed or bamboo pole (with the nodes opened up and holes in the side) helps air get into the heap. It also allows you to measure the temperature of the compost better.
- → Cover the heap with dry grasses or crop residues,
- → In cold, highland areas cover the sides of the heap with soil,
- → Let the pit/heap decompose for about 3-5 weeks
- → After 3 weeks in semi arid areas and 5 weeks in moist areas, the compost should be turned and mixed in order to aerate the heap
- → Repeat the operation of turning for 1 to 3 times at regular intervals and let the compost mature.
- → If the steps are properly followed, the approximate duration of the composting process is from 2 – 5 months with the shortest in arid.

- → Actually, the time required for the preparation of compost will depend on the type and composition of organic residues and operation and management applied.

# Cont'd

- ***Maturing the product:***

✓ The weight of the waste materials shrinks to about half of the original amount due to oxidation of carbon-to-carbon dioxide and loss of moisture,

✓ The volume reduces to nearly one third,

✓ The colour changes to dark/brown-black.

✓ Mature compost is homogenous in colors and texture, light in weight and spongy in appearance.

# Cont'd

Compost heaps under a shade

# Cont'd

- ***Use of compost***
  - ✓ Compost is a highly quality material and should be applied carefully.
  - ✓ It should not be spread over the whole field and not be exposed to direct sunlight and heat.
  - ✓ Apply it in holes near the plant.
- ***Estimation of compost yield***
  - ✓ The amount of organic wastes required for compost preparation depends on the volume of the pit or heap.
  - ✓ A pit having a volume of $1m^3$ requires about one-third of a ton of organic materials.
  - ✓ That is, a compost heap having $3m^3$ requires about 1 ton organic wastes.
  - ✓ To produce about one ton compost, it requires nearly 3 tones of organic materials.

Compost management and application,

Do you have comments??

# Cont'd

## *2.3 Vegetative Soil Conservation Measures*

- ✓ They are applied to potential lands to maintain or increase their productivity, or on degraded lands to restore productivity
- ✓ They are made of various vegetation; predominantly trees, shrubs, grasses and herbaceous legumes applied in combination or pure in various forms for different purposes.
- ✓ The vegetative measures are intended to: obstruct the force of runoff; stabilize structures; rehabilitate farm and grazing lands; and stabilize degraded/fragile lands.

# Cont'd

- ***Hedgerow planting***

✓ Hedgerows can be defined as narrow rows of dense vegetation with sufficient height above the ground.

✓ Hedgerow can be formed from grasses or shrubs.

✓ Therefore, hedgerows can be called: hedgerows of grasses, hedgerows of shrubs/trees, or specifically, hedgerows of Leucaena, hedgerows of Sesbania, hedgerows of Vetiver grass, etc.

✓Leguminous species like sesbania and pigeon pea can be used to establish a hedge.

✓Trimming the hedges to a height of 30-50cm prevents from seeding, makes them thicken up, and thereby increases the effectiveness in filtering out soil particles.

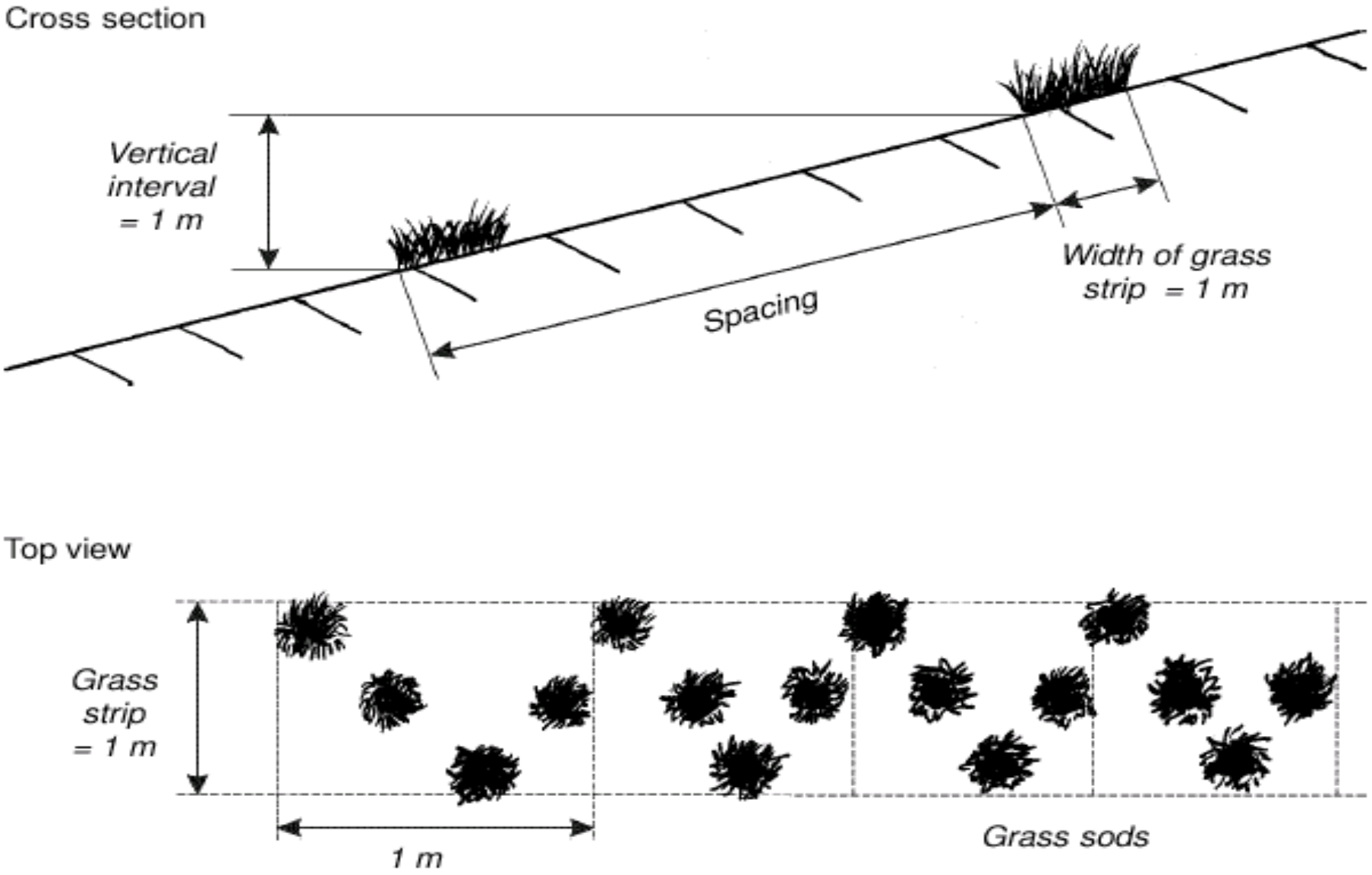
# Cont'd

- ***Stabilization of physical structures***
  - ✓ All physical structures including bunds/terraces, moisture harvesting structures, ponds, cut-off drains, waterways and various structures installed in gullies need to be stabilized with vegetative measures to ensure their sustainability and enhance productivity

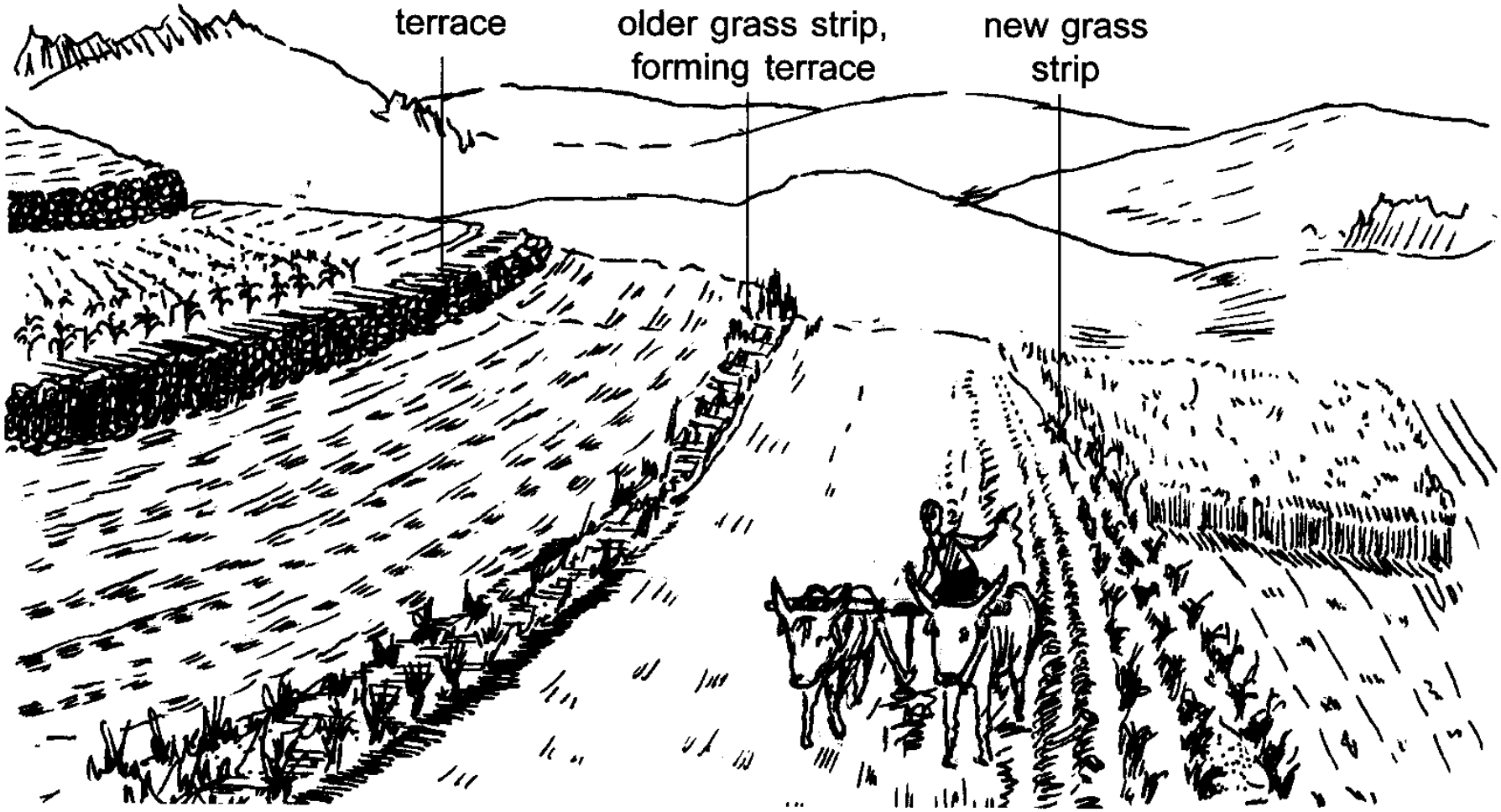
# Grass strips

- ✓ Grass strips are narrow strips of **naturally growing** or **planted grasses** laid out on the **contour** or **on a graded line**.
- ✓ The width of the grass strip mainly depends on the density of the grass (vegetation) in the strip (commonly from 0.5 – 1.5 m)
- ✓ Their objective is to ***control erosion*** rather effectively in gentle slopes, i.e 3-8% slope (but above 8% slope their effectiveness decreases).

Grass strips for farmland treatments




*Cross-section and top view of grass strips*




Grass strips are used on gentle slopes while terraces are used on steep slopes

# Type of grass strips

## 1. Un plowed grass strip

- it is a strip of grass established along the contour naturally or through natural regeneration

## 2. Plowed grass strip

- it is a strip of grass established along the contour through proper seed bed preparation and planting or sowing of grasses

# Adaptability to local knowledge:

✓ There are grass strips in various parts of the country, often *in the form of* ***buffer strips*** *of land left uncultivated* and filling up with spontaneous grass.

- This is done with the dual purpose of allowing some valuable grass to grow and to control runoff.
- This system is usually not of permanent nature.

➢***Standard grass strips technology*** was introduced by different projects but did not meet the expected success, mostly because of the difficulty to control free grazing.

# Applicability of the technology:

***Land use*:** Grass strips are *suitable for cultivated land*,

***Agro-ecology*:** Mostly *in medium and high rainfall areas* (moist weyna-dega and dega).

- Within the context of moisture deficit areas grass strips *can be applied in semi-arid areas* and but *not for arid areas*.
- In general; They can be effective where there is sufficient rainfall, supplementary irrigation and in-situ moisture conservation.

***Slopes:*** appropriate in slopes 3-8%

- For slopes 8% *up to 15% they may be planted alternatively with bunds* (one grass strip - one bund).
- *In dry areas*, grass strips *should not be established on slopes > 8%*.

## Types of grass to be planted:

✓ perennial and persistent,
✓ compete with and suppress weeds, provide good ground cover,
✓ provide physical impediment to flow and hence conserve the soil and moisture

❖ There are number of grass species that can be effective in grass strips, such as Rhodes, Andropogon, Setaria, Phalaris, Vetiver, etc. but, also native grass (e.g. Pennisetum spp.) can be used.
❖ Advantage of using Local / native grass species is that they may be more adaptable to local conditions and tolerant to drought,

# Cont'd ---

• Besides, *land users are familiar with the purpose and management* of such grasses.

However, some grasses are aggressive to rapidly colonize the surroundings.

**Leguminous species:**

• species such as Stylo, Siratro, Desmodium for drier areas, and

• Clovers and Medicago in other areas should be tried.

However before establishment, Forage/ livestock specialists should be consulted prior to the selection of this spp.

# Suitable Grass/legume Species in relation to agro-ecology

| Agro-ecology | Grass species | | Legumes |
|---|---|---|---|
| | Exotic | Local | |
| Dega | Phalaris aquatica, Vetiver | Desho (ደሾ), Guasa Sar (ጉሞሳ), Sindedo (ስንደዶ) | Treelucern |
| Weyna Dega | Vetiver, Phalaris, Rohdes, Kukuyu, Setaryia spp, and Buffle. | Desho (ደሾ), Senbelet (ስንበሌጥ), Sindedo (ስንደዶ) | Pigeon pea, Leucaena, Sesbania, Alfalfa, Treelucern, Desmodium, Acacia spp. |
| Kolla | Rhodes, Buffle, Vetiver | Sendedo (ስንደዶ) | Pigeon pea, Leucaena, Sesbania, Desmodium, Alfalfa, Accacia spp. |

# Existing practices of grass strip establishment

# Unplowed strip

# *Waterway with grass strips*

***Reserved area for grass split production (grass strip plantation)***

# ***Examples of Grass strips in various parts of** our zone:*

# **Desho:** grass strips

# Nursery for grass seedling production

# *Combination of grass strips with legume spp:*

# Advantages and Limitations

## Advantages

- ✓ Grass strips cause less interference to farm operations than other structural measures.
- ✓ They can easily be crossed by oxen and do not pose difficulties in turning around.
- ✓ Moreover, grass strips also take up less land and hence economize the land for crop production.
- ✓ Controls erosion and runoff,
- ✓ Increases soil moisture and infiltration,
- ✓ Cut grass can be used as fodder or mulch,
- ✓ Cost of construction is much lower than physical structures

# Advantages and Limitations…

## Limitations

- ✓ If not properly maintained the grass might spread and become a weed problem.
- ✓ Takes up land that otherwise might have been used for crop production.
- ✓ The grasses might serve as a refuge for rodents.
- ✓ Planting materials might not be available locally
- ✓ Not effective in arid areas,
- ✓ When they are newly established, the strips do not offer much protection against erosion

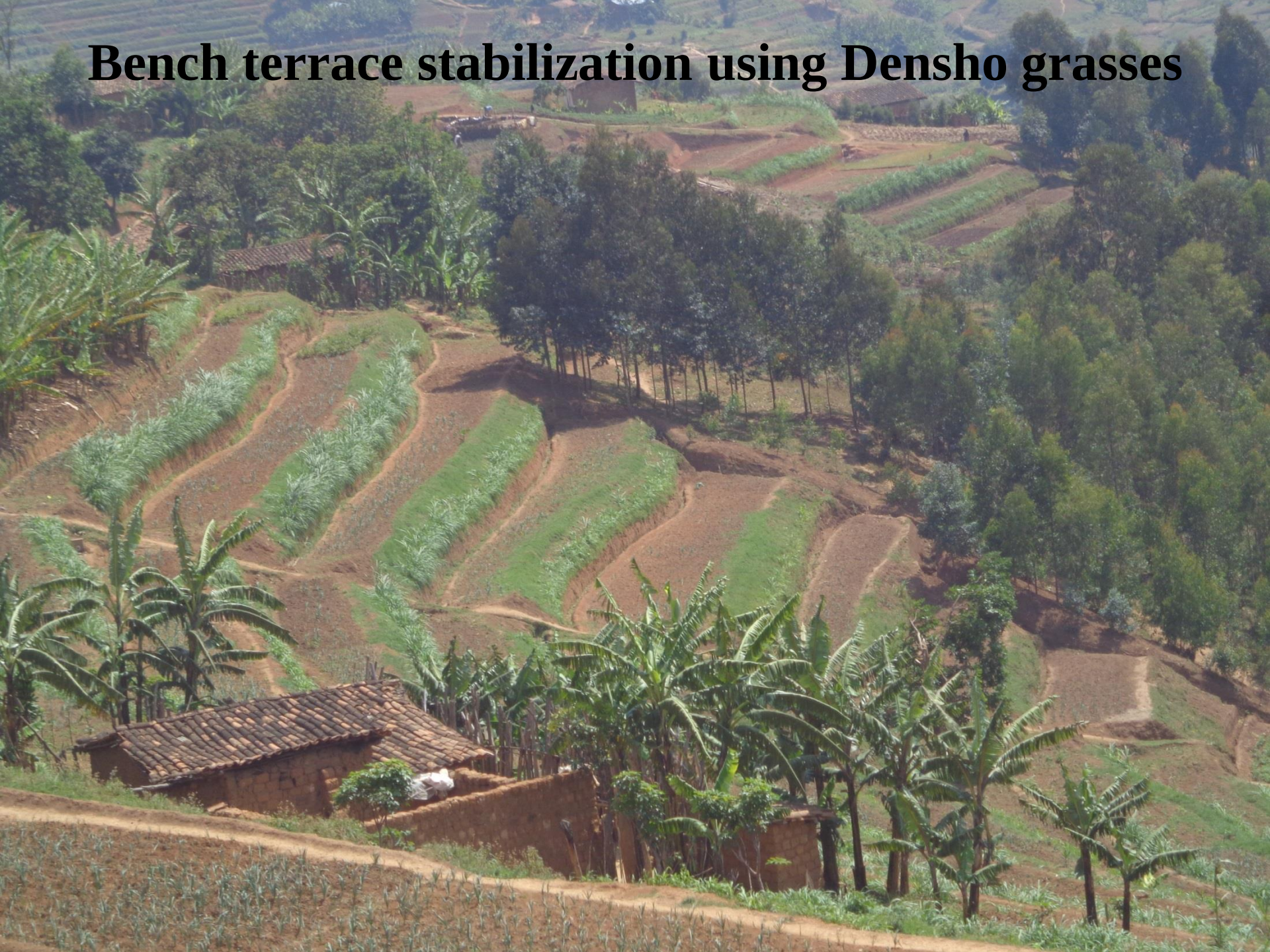
# Well managed trelucern

# Well managed trelucern

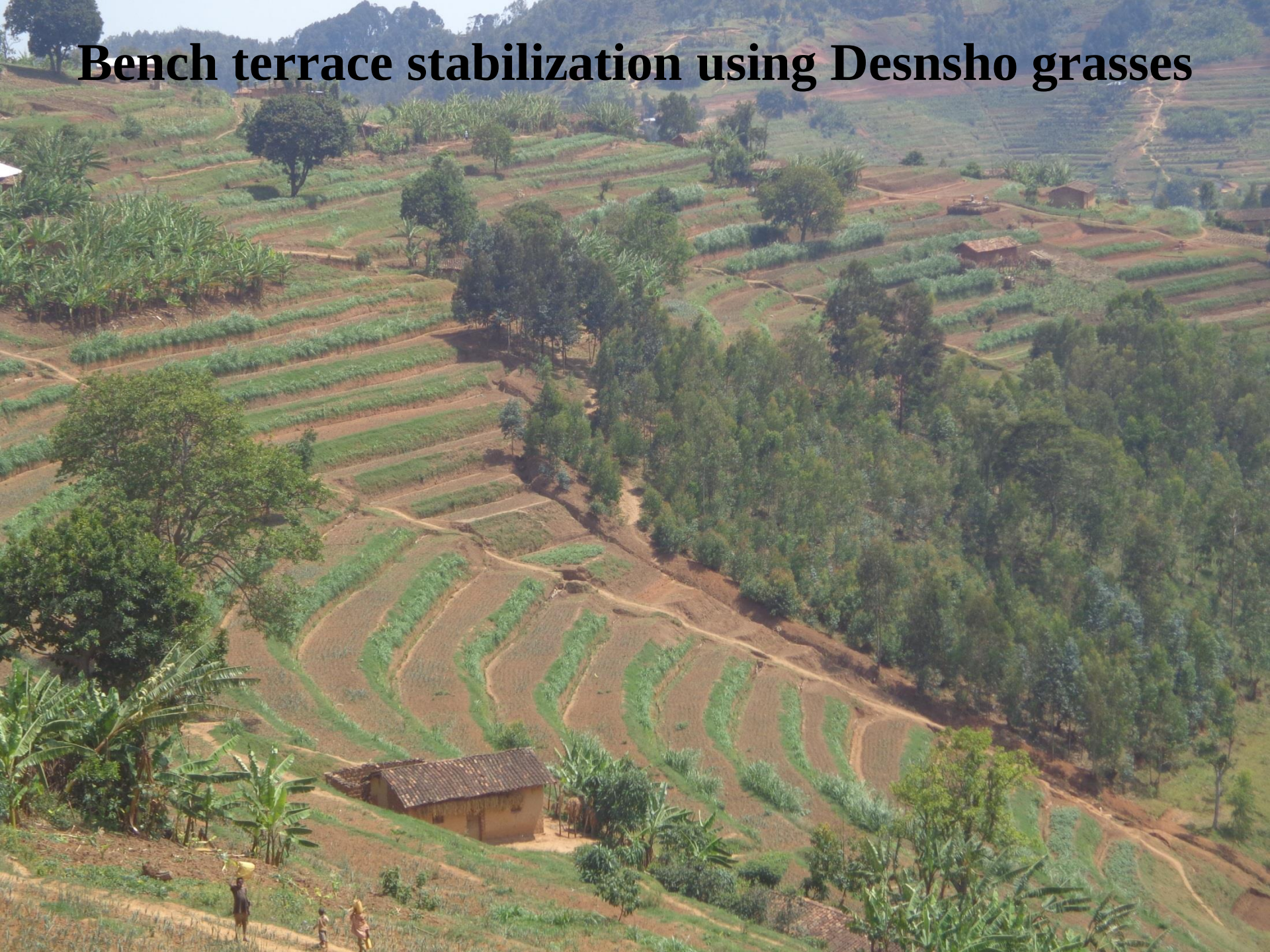
# Gravellia on bund for timber production

# Pigeon pea and other fruit trees on bunds

# Bench terrace stabilization using Densho grasses



# Bench terrace stabilization using Desnsho grasses




Thank U!

# Discussion